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AN ENTOMOLOGIST IN COSTA RICA.*

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Until the separation of Panama as an independent state from Colombia, Costa Rica was the southernmost of the five republics of Central America. It lies between Nicaragua on the north and Panama on the south, from latitude 11° to 8° North. Its general trend is from northwest to southeast, and through its entire length runs a series of peaks, many of them volcanoes, whose greatest altitude is above 12,000 feet. North of the 10th parallel, this chain divides into two branches one of which, extending in a more easterly direction toward the Atlantic, is composed chiefly of the volcanoes Poas (8786 ft.), Barba (9508 ft.), Irazu (11326 ft.) and Turrialba (10965 ft.). The other branch, retaining the southeastward trend, is continued by the Cordillera of Chiriqui in Panama and includes the highest elevations in the country. Along the 10th parallel the distance from the Atlantic to the Pacific is 185 miles, but if we measure to the eastern shore of the Gulf of Nicoya, that is from the port of Limon to Puntarenas, 125 miles. The railroad in making this transit climbs to 5000 feet and this ascent together with its windings increases the actual distance to 175 miles.

The prevailing easterly trade winds coming from the Caribbean, laden with moisture, strike against the lofty mountains and cause a heavy precipitation on the Atlantic slope throughout much of the year. Sheltered by the same peaks the Pacific slopes and even some localities on the Atlantic, like Cartago, receive a smaller precipitation until southerly winds bring moisture from April to November.

*Abstract of address before the Entomological Society of America, Cleveland, Ohio, Jan. 1, 1913. The address was illustrated by a very fine series of lantern views from photographs of insects and localities of scientific and scenic interest. —Ed.

Passing from east to west, the average annual rainfall at Limon is 126.8 inches, Juan Viñas 85.6, Cartago 60.7, with minimal average monthly precipitations of 5, 2.5 and 1 inch respectively (all these on the Atlantic slope), while corresponding figures on the Pacific slope are 76 inches for Tres Rios, 76.4 for San Jose and 62.1 for Nuestro Amo, the minimal average monthly rainfalls being .12, .43 and 0 inches respectively.

The abundant rainfall gives rise to many streams of all sizes. Erosion and the undermining of the loose soil have cut the surface of the land into many deep ravines and canyons, producing a rugged topography and making travel difficult and time-consuming. Within short horizontal distances are great differences of elevation. This, in turn, has affected the character of the vegetation and of the fauna. Pronounced segregation of many living things is consequently often the case, and the richness of the biota, as estimated by the number of species, is greatly increased.

Pittier, in 1908, gave the number of species of flowering plants of Costa Rica as 3441; the corresponding number for New Jersey is 1351 (Stone, 1910). Carriker, in 1910, listed 753 species and subspecies of birds from Costa Rica, or more than half the total number (1196) for America north of Mexico in the A. O. U. check list of the same year, and twice as many as have been recorded in recent years for Maine (327), Colorado (392) or Washington (372); the smallest of these three has an area at least a third greater than that of Costa Rica which is only 23,000 square miles. Rehn, in 1905, gave a partial list of 195 species of Costa Rican Orthoptera, as against 154 species in the far more thoroughly explored state of New Jersey. Godman and Salvin, in 1901, enumerated 236 genera of Costa Rican butterflies; Dyar, in 1902, recognized 152 genera for America north of Mexico. Schaus has found 150 Costa Rican species of the butterfly genus *Thecla*, as contrasted with 56 species in America north of Mexico.

All of these characteristics make Costa Rica a Paradise to the naturalist. Its variety of altitude offers variety of temperature. The short distance from the shores of the Atlantic to those of the Gulf of Nicoya, an arm of the Pacific, and the existence of the transcontinental railroad render it possible to pass from one to the other in ten hours; a comparison of conditions at similar altitudes on the two slopes of the divide may be easily

and quickly made. In the higher parts of the country the climate is salubrious and invigorating, and with a little care one may safely investigate the heated lowlands. Proximity to South America, with no intervening barrier, has permitted the invasion of many denizens of the Southern Continent, while not a few cases of continuous distribution from North America are also in evidence. The most orderly of Central American countries holds its presidential elections with as much enthusiasm and with less disturbance than those of the United States. A peaceful and hospitable people and an enlightened government render the stranger's visit an event to be remembered by him with delight throughout a lifetime.

In one or other of these qualities, Costa Rica is excelled by Mexico, Colombia or Brazil, but by none in the totality of the advantages which it offers to the students of all the branches of ecology in its widest sense. One shadow, indeed, hangs over the fair land—that of the earthquakes which within two centuries have thrice destroyed the town of Cartago, lying on the southern slopes of the volcano Irazu, the latest destruction being that of May 4, 1910, when it was serving as our own headquarters.

During the year, May 1909, to May, 1910, insects, especially Odonata (dragonflies) were collected and studied at the following fourteen groups of places and at intervals, in order to obtain data on seasonal distribution.

On the Atlantic slope:

Banana River region, 50 feet, November.
Guapiles, 984 feet, June, November.
Peralta, 1088 feet, August, March.
Turrialba, 2000 feet, July.
Juan Viñas, 2500–4000 feet, June, August, October, December, February, March April.
Cachi, 3600 feet, March.
Cartago, 4750 feet, every month.
Volcano Irazu, 4750–11300 feet, July, September, March.

On the Pacific slope:

Tres Rios and La Carpintera, 4260 to 5700 feet, December, March.
Alajuela, 3100 feet, September, December.
Turrucares, 1800–2200 feet, August, December, April.
Surubres, 800 feet, October.
Puntarenas, 10 feet, February.
Guanacaste, 0–2200 feet, January.

Four of these localities are here described briefly.

Juan Viñas, on the Atlantic slope, was particularly fruitful as a collecting ground owing to its combination of many of the advantages mentioned above. The railroad station, 73 miles from Limon, and at an altitude of 3300 feet, is on the bottom of an old crater the rim of which, at the general level of the country, is 700 feet higher; the village of Juan Viñas is at this latter elevation. From the railway, in half an hour, one may reach the Rio Reventazon, 800 feet below. The canyon of this river thus has a depth of 1500 feet, and presents a great variety of slow- and of swift-flowing brooks, cascades, waterfalls, forest, swamp, bare rock and dense vegetation. It was productive of material illustrating previously unknown life-histories of interesting Odonata (*Cora*, *Mecistogaster*, *Thaumatoneura*, *Philogenia*, *Palaemnema*, etc.).

Surubres, on the Pacific side, at an altitude of about 800 feet, was a favorite with the late Professor Paul Biolley, where he gathered much insect material subsequently sent to entomologists in the United States and in Europe. A week was spent in the hacienda, which he occupied on several occasions, but at a different time of year, to secure data to supplement those which he obtained.

The northwestern province of Costa Rica, Guanacaste, has been little visited by entomologists. Thanks to Professor J. F. Tristan, the writer accompanied an official educational commission thither, and collections and observations were made at Filadelfia, Liberia, Santa Cruz, and Hacienda Guachipelin. The last named, at an altitude of 1700 feet, is not far from the still unexplored Volcano Rincon de la Vieja.

Cartago, near the top of the Atlantic slope of the railroad, was, until its destruction, alluded to above, a convenient center for visits to various parts of the country and served as the breeding place of living material collected on these excursions.

(Other aspects of this visit to Costa Rica have been described in *Entomological News*, vol. XXI, pp. 334–337, July, 1910, and in *Old Penn Weekly Review of the University of Pennsylvania*, vol. IX, pp. 165–170, Nov. 12, 1910. Some of the results obtained from studies on Costa Rican Odonata have been published in *Entomological News* for 1910, 1911 and 1912, and will probably be continued in subsequent volumes of the same journal.)